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RESEARCH ARTICLE

Art Innovation or Plagiarism? Chinese Students' Attitudes Toward AI Painting Technology and Influencing Factors

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ABSTRACT The increasing integration of artificial intelligence (AI) in art, particularly AI painting technology, has captivated significant attention and sparked debate. However, little is understood about the attitudes of Chinese students toward this technology and the factors influencing their perspectives. This study employed a mixed-methods approach to comprehensively appraise Chinese students' attitudes toward AI painting technology and the reasons behind these viewpoints. Data was collected from five universities and three high schools in China through questionnaire surveys and semi-structured interviews. Quantitative analysis demonstrated clear trends in students' attitudes toward AI painting technology, with gender, educational level, and background in art and design identified as significant influencing factors. Specifically, students with higher levels of education demonstrated more favorable attitudes toward AI painting technology. This was evidenced by a strong positive correlation coefficient of 0.644 ($p<0.01$) between educational attainment and positive perceptions of this technology; whereas, a negative correlation with gender (coefficient of -0.263, $p<0.01$) indicated a difference in attitudes between male and female students, with males displaying more positive views. Specifically, background in art and design did not appear to significantly affect students' attitudes, as presented by an insignificant correlation coefficient of -0.048 ($p>0.05$). In addition, regression analysis, with an R^2 value of 0.419, suggests that these variables can account for 41.9% of the variance in student attitudes toward AI painting, emphasizing the significant effect of gender and education level on their perspectives. Qualitative findings further indicated that concerns about copyright ethics, job displacement anxieties, personal values and aesthetic viewpoints, and broader social and environmental implications all affected students' attitudes toward AI painting technology. These findings offer valuable insights into the attitudes toward AI-generated technologies.

INDEX TERMS AI art, AI painting, student attitudes, education and AI, mixed methods research.

I. INTRODUCTION

Public perception of and engagement with artificial intelligence (AI) products have attracted growing attention recently [1], [2]. Some researchers champion AI as a means of enhancing creative processes, cultivating greater accessibility, and diversifying creative participation [3]. However, studies also point to cognitive biases against AI-generated content [4], [5], [6]. This phenomenon is reflected in text-to-image generation, where AI Art, alternatively termed "AI Painting" or "Generative Art," [7], [8] has blossomed, driven by AI's impressive image-generation capabilities. Therefore, AI has gained traction as a popular tool for digital artists [9], [10], [11]. However, researchers have documented cognitive biases and negative reactions to AI painting [12], [13], [14], [15]. Specifically, negative biases toward AI become

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particularly significant when AI is considered having abstract capabilities, emotional depth, or creative agency [16], [17], [18], [19].

The art world has recently witnessed a surge of opposition against AI painting. On ArtStation, for instance, artists initiated a "No AI Art" movement, demanding a ban on such content [20]. This discontent escalated further when a group of visual artists filed a lawsuit against prominent AI art companies, Stability AI Ltd, Midjourney Inc, and DeviantArt Inc, alleging copyright infringement [21]. Moreover, a Reddit user's attempt to placate artists by training a model for AI paintings in the style of renowned concept artist Paul Chadeisson backfired. Despite the user's intention to honor Chadeisson, the artist voiced his disapproval, albeit subtly [22].

The use of AI in art has ignited considerable controversy, particularly regarding potential copyright infringement [23]. This debate notwithstanding, many researchers remain optimistic about AI painting technology. Some hypothesize that generative AI offers a novel avenue for artistic expression [24], acting as a collaborative partner in the creative process [25]. Therefore, a growing number of artists and designers are incorporating these tools into their work [26]. The 2022 Colorado State Fair Art Competition brought this issue to the forefront when "Théâtre D'opéra Spatial," a piece created by designer Jason M. Allen utilizing the AI tool Midjourney, was awarded first prize [27]. This event further blurred the lines, leading some to title individuals who leverage AI to produce stunning digital images "AI artist" [28], [29]. As AI demonstrates increasingly sophisticated creative capabilities [30], [31], it appears that we are entering a new age where AI painting technology is poised to become an indispensable tool for digital image creation. Understanding the attitudes and influencing factors of the current younger generation, particularly students, toward this technology is thus crucial.

According to these premises, this study will employ a mixed-methods approach to appraise the attitudes of Chinese students toward AI painting technology and the factors that affect them. The first phase will involve designing a questionnaire, informed by the Technology Attitude Scale, PAQ scale, and the specific characteristics of AI painting. This quantitative survey design is strongly supported by previously verified questionnaires. Then, in-depth key informant interviews and semi-structured interviews will be conducted to offer richer insights into the authentic experiences and perspectives of diverse students regarding AI painting. This qualitative data will be instrumental in understanding the factors affecting the spectrum of student attitudes toward AI painting. The final phase will focus on discussions and the synthesis of key findings. This research is innovative on several fronts. First, it offers a comprehensive view of student attitudes toward AI painting technology, a topic insufficiently explored in existing research, by integrating quantitative and qualitative methodologies. Second, the research bridges disciplines such as AI, psychology, and art, thereby offering a unique interdisciplinary perspective for analyzing how novel technologies affect creative processes. Finally, the findings of this study will not only deepen our understanding of how AI painting technology is perceived, but will also inform the development of educational programs and AI tools that are better aligned with student needs and preferences.

II. RELATED WORK

A. DEVELOPMENT AND APPLICATION OF AI PAINTING

It is evident that AI technology has significantly affected the art world, particularly in painting [26]. The recent developments of sophisticated text-to-image generative models have made AI-powered art creation increasingly popular, allowing for the generation of visual content and artwork from natural language prompts [24], [32], [33], [34]. However, this exploration of AI's potential in painting actually began much earlier.

In the 1970s, artist Harold Cohen pioneered the "AARON" program, aiming to empower a robotic arm with painting abilities [35]. The robotic arm, however, remained limited by its rigid movements, incapable of the fluid strokes essential for true artistic expression. The dawn of the 2010s brought a critical moment for AI in the art world, spurred by Google Brain's development of a large-scale neural network. Trained on an immense dataset of cat images extracted from YouTube videos by Andrew Ng and Jeff Dean, this network demonstrated the potential of automated learning for both image recognition and creation, even if the generated cat faces were somewhat blurry [36]. The introduction of Generative Adversarial Networks (GANs) in 2014 marked a significant leap forward in AI-based image creation. This framework, comprised of a generator and a discriminator, excelled at learning the structure of images, enabling it to produce realistic and high-quality paintings without relying on labeled datasets. Notwithstanding its success, the GAN model suffered from challenges such as image distortions, complex training processes, and a significant need for computational power [37], [38], [39]. Fast forward to 2021, the OpenAI team unveiled CLIP (Contrastive Language-Image Pre-Training), a model capable of not only simultaneously processing text and images but also understanding and generating both forms of content [40]. This breakthrough paved the way for Disco Diffusion [32], the first practical AI painting application built upon the CLIP+Diffusion model. Disco Diffusion's strength lay in its ability to produce high-resolution images with impressive quality while offering greater control over the generation process, allowing for enhanced customization. However, it still struggled with blurriness in many details, falling short of the crispness expected in professional production. Building upon research on "Latent Diffusion Models" [41], Midjourney and Stable Diffusion effectively addressed these limitations.

In rapidly evolving and iteratively developed digital art, AI paintings are approaching a critical juncture. This point signifies a potentially transformative integration of technological capability and artistic creation. Existing research offers perspectives on the evolving relationship between AI and painting. Studies have analyzed the creative potential of AI in artmaking [42], offered reflections on the technological basis of AI painting [43], and explored the attitudes held toward AI painting by both art and non-art majors [44]. In addition, comparative analyses of human and AI paintings have been conducted [45]. The role of prompts in AI painting has been a particular focus of research [46], [47], [48]. While users may engage in a process of "trial and error" to achieve their desired artistic outcomes—a process often rooted in an incomplete understanding of prompt utilization [11]—AI technology significantly expands the creative possibility. Both trained artists and individuals without formal artistic training can readily produce compelling works. Considering the evolving human-AI collaboration in artistic creation, close study of AI painting's future development and the perspectives of student populations is paramount. Therefore, further research concerning student attitudes toward this technology is essential.

B. STUDENTS' ATTITUDES TOWARD TECHNOLOGY

Researchers have extensively explored the concepts of enthusiasm, enjoyment, and boredom [49], [50], as well as attitudes toward technology [51], [52]. This holds particular significance in educational settings, as understanding students' technological literacy and attitudes is crucial for effective technology education [53]. Therefore, in the contemporary era affected by artificial intelligence, it is essential to appraise student perspectives and attitudes toward AI technology.

Research practices often indicate the many ways researchers define and approach technology attitudes [54]. Some researchers, for instance, focus on student perspectives on technology use in educational settings [55], [56]. Others concentrate on personal beliefs about technology's societal influence and practical applications [57], [58]. Still others prioritize the feelings and emotions associated with technology use (for instance, comfort, anxiety, personal preferences) [59], [60], [61]. Specifically, several researchers have introduced frameworks and scales to evaluate student perspectives on technology. De Vries [62], drawing on his own research and similar international studies, established five dimensions for understanding these attitudes. Similarly, Bame and Dugger's 1990 PATT-USA study and Jeffrey's 1993 adaptation (TAS-USA) offered instruments for middle school teachers in the United States to measure student attitudes toward technology [51]. However, existing questionnaires that solely assess learner attitudes toward technology are insufficient for the aims of this study. Therefore, this study draws upon the technology attitude scales of Pell and Ardies, and Yavuz, and the (PAQ) scale of Ho and Lin, to develop a new scale measuring student attitudes toward AI painting [49], [55], [56], [63].

C. RESEARCH HYPOTHESES

Recent years have witnessed a surge in research comparing the attitudes of male and female students toward technology [64]. This line of study has consistently indicated a pattern: in the technology, girls exhibit more negative perceptions of technology compared to their male counterparts [65], [66]. This observation is further corroborated by Rees and Noyes [67], whose study highlighted the particularly favorable attitudes male students hold toward technology. However, there is a growing body of evidence suggesting that as females experience increased exposure to and interaction with technology, the gender difference in technology use, including attitudes toward its application, may be steadily decreasing over time [54]. Therefore, we propose the following hypothesis:

H1: Students' attitudes toward AI painting technology are significantly affected by gender.

Kotte [68] and Catsambis [69] suggest that the technology attitude gap between males and females correlates with age. This aligns with recent findings from Beggs and Murphy [70], Pell and Jarvis [49] and Haworth et al. [71]. In addition to age, researchers have also evaluated how technology attitudes differ across academic grades and levels. For instance, research indicates a decline in technology interest between students' first and second year of secondary education [56]. However, in a study on e-assessment attitudes, Bahar and Asil found no significant effect of educational level on attitudes toward e-assessment use [72]. It is important to note that the student sample in our study, primarily composed of high school, undergraduate, and postgraduate students with significant exposure to AI painting technology, differs from those in lower grades. This highlights a gap in the existing research, as few studies have specifically analyzed this demographic. Therefore, to better understand the attitudes of students at various educational levels toward AI painting, we propose the following hypothesis:

H2: Students' attitudes toward AI painting technology are significantly affected by their educational level.

Páivi M. Tikka's research demonstrated attitudinal differences among different student groups. Regarding environmental attitudes, biology students exhibited the most favorable attitudes and highest knowledge levels, while students in technical and economic fields displayed more negative attitudes [73]. Similarly, a separate study assessing Tennessee State University (TSU) students' views and attitudes toward biotechnology observed significant differences between social science and bioscience students. Another study analyzing TSU student perceptions and attitudes toward biotechnology yielded similar findings, indicating significant differences between those studying social sciences versus biosciences [74]. Considering these precedents, we hypothesize that students with art and design backgrounds may harbor

TABLE 1. Participants' profile (N = 1298).

Demographic		Frequency	%	Cumulative %
Gender	Male	647	49.85	49.85
	Female	651	50.15	100.00
Age (Years)	<18	313	24.11	24.11
	18-30	732	56.39	80.51
	>30	253	19.49	100.00
Education level	High school and below	514	39.60	39.60
	Under graduate	415	31.97	71.57
	Post graduate	369	28.43	100.00
Artistic Design Background	Yes	710	54.70	54.70
	No	588	45.30	100.00
	Total	1298	100.0	100.0

unique attitudes toward AI painting technology compared to their peers without such backgrounds. Therefore, we propose the following hypothesis:

H3: Students' attitudes toward AI painting technology are significantly affected by their background in art and design.

III. RESEARCH METHODS

A. DATA COLLECTION AND PARTICIPANTS

This research utilized a mixed-methods design to study students across five Chinese universities and three high schools. The quantitative survey phase ran from January to March 2023, followed by the qualitative data collection phase from April to May 2023.

This study evaluates the perceptions of Chinese students toward AI painting, specifically analyzing their attitudes and opinions. To ensure the relevance and depth of our findings, participation was carefully limited to students with a foundational understanding of AI painting, including practical experience with related tools and concepts. This approach allowed for the collection of a highly reliable sample, directly contributing to the successful realization of the research objectives. Collaboration with teachers was key in recruiting suitable participants who met the predetermined criteria. These teachers promoted and distributed the survey link through various channels, such as classes and student communities, effectively extending the invitation to participate to eligible individuals. ''Wenjuanxing,'' a widely utilized online survey platform in mainland China, constituted the platform for questionnaire administration. To further incentivize participation and expand the study's reach, students who completed the survey and shared the link with their networks received a valuable resource guide titled ''How to Ask Questions to ChatGPT and Get High-Quality Answers.'' This multifaceted approach yielded a robust response rate, finally obtaining 1,298 valid responses from a pool of 1,439 participants (Table 1).

B. MEASURES

The first section of the survey presents frequency statistics of the participants. The second section, comprising nine items, evaluates the overall attitude of the student groups toward AI painting. The section on attitudes toward AI painting adopts a combined technology attitude and PAQ scale, adapted from previous research. The original survey items were adjusted to align with the specific characteristics of AI painting and meet the study's design requirements. A five-point Likert scale, ranging from 1 ''strongly agree'' to 5 ''strongly disagree,'' was utilized to evaluate each item. It is important to note that the questionnaire was initially presented to participants in Chinese and translated into English through back-translation to maintain data consistency. Following the questionnaire design, a pilot test was conducted. Fifty students were invited to complete the survey to assess the internal consistency of each item and offer feedback on the content's accuracy in reflecting their attitudes and perceptions of AI painting. The results indicated that the research model achieved an acceptable Cronbach's alpha (> 0.8).

C. QUALITATIVE STUDY

During our fieldwork including numerous higher education institutions and high schools across China, we witnessed a spectrum of perspectives among young students regarding the emerging AI painting technology. While a considerable number of students exhibited enthusiasm toward it, we also encountered a sizable contingent harboring reservations. To acquire a more comprehensive understanding of the elements affecting these viewpoints, the researchers formulated a sequence of interviews.

Interviews, each lasting 40-60 minutes, were conducted by researchers highly experienced in utilizing AI painting systems. This qualitative study incorporated a multi-faceted approach: 32 key informant interviews (KIIs), 14 in-depth semi-structured interviews (IDIs), and 5 focus group discussions (FGDs) were held. The number of participants, categorized by education level and interview type, is displayed in Table 2. Focus groups were composed of six individuals on average (2 females and 4 males). Our research carried out an in-depth study of the factors influencing Chinese students' attitudes toward AI painting. To analyze the formation of these attitudes, we explored this multifaceted issue from various angles. Therefore, we uncovered the process of concept formation and decision-making among the student groups, a process closely associated with their attitudes toward AI painting. Employing an inductive approach, we observed and documented the dialogues, interviews, and practices of these student groups. Through this method, we were able to extract perspectives on AI painting held by the students. For the coding of interview and group discussion transcripts, we utilized NVivo version 8. Both the design and implementation of this quantitative and qualitative research project adhered to internationally recognized ethical guidelines for research. This included, but was not limited to, guaranteeing participant autonomy, upholding fairness, striving for the optimal benefit-risk ratio, and ensuring the privacy and confidentiality of all participants. Written informed consent was obtained from the legal guardian of each participant prior to their inclusion in the study.

TABLE 2. Participants' education level and interview type (N = 76).

Type of participant	Number of KII	Number of IDI	Number of FGD
High school and below	12	3	11
Undergraduate	13	6	13
Postgraduate	7	5	6
Total	32	14	30

IV. RESULTS

A. QUANTITATIVE STUDY AND PRELIMINARY DATA ANALYSIS

Before proceeding with the analysis of variance, the study analyzed the reliability and validity of the measurement items (indicators) and scales (constructs) [75]. First, the loading of each indicator was evaluated, with a loading of ≥ 0.708 signifying acceptable item loading. Table 3 illustrates that all item loadings surpass the recommended value, suggesting adequate reliability for each item. Second, internal consistency was evaluated utilizing two measures: Cronbach's Alpha (α) and composite reliability (CR). The minimum acceptable values for α and CR are suggested to be 0.7 and should not exceed 0.95. All constructs satisfy these criteria (Table 3), indicating the presence of internal consistency in all constructs. Finally, convergent validity was determined by analyzing the "Average Variance Extracted (AVE)." The minimum acceptable AVE value is 0.5. As evident from Table 2, the AVE value of 0.654 surpasses the required minimum value, signifying the existence of convergent validity in all constructs.

Then, we assessed the factor validity to determine if the research items are well-founded and conceptually sound. This assessment employed factor analysis methods such as KMO values, commonalities, explained variance values, and factor loading coefficients to determine the level of data validity (Fabrigar et al. 1999). All research items' communalities are above 0.666, indicating effective information extraction. Moreover, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.966, exceeding the 0.6 threshold and signifying the data's suitability for robust information extraction. Besides, the explained variance, both before and after rotation, stands at 69.235%, with the cumulative explained variance after rotation also reaching 69.235%, surpassing the 50% benchmark. This suggests that a significant degree of information can be effectively extracted from the research items.

B. MEASUREMENT CORRELATION AND REGRESSION

We proceeded to analyze the correlation and regression analyses. These statistical methods determine the strength and type of connections between research variables. Metrics such as the Pearson correlation coefficient, linear regression coefficient, and coefficient of determination allow us to appraise the relationships and predictability in the data.

Table 4 presents a correlation analysis analyzing the relationships between students' attitudes toward AI painting and variables such as Gender, Education level, and Artistic Design Background. The Pearson correlation coefficient was employed to represent the strength and direction of these relationships. The analysis indicates a significant negative correlation between Gender and attitudes toward AI painting, as evidenced by a correlation coefficient of -0.263. This suggests that as Gender changes, attitudes toward AI painting tend to shift in the opposite direction. In addition, Education level demonstrates a significant positive correlation with attitudes toward AI painting, with a correlation coefficient of 0.644. This indicates that higher education levels are associated with more favorable perceptions of AI painting. However, the analysis did not indicate a significant correlation between Artistic Design Background and attitudes toward AI painting. The correlation coefficient, -0.048, is insignificant and the p-value exceeds 0.05, signifying that variations in Artistic Design Background do not appear to be correlated with differences in attitudes toward AI painting.

Table 5 indicates that the model's R^2 value is 0.419. This suggests that Gender, Education level, and Artistic Design Background account for 41.9% of the variability in student attitudes toward AI painting. The model successfully passed the F-test ($F=310.936$, $p=0.000<0.05$). This result indicates that at least one variable—Gender, Education level, or Artistic Design Background—influences student attitudes toward AI painting. The regression coefficient for Gender is -0.120 ($t=-2.864$, $p=0.004<0.01$), demonstrating a significant negative correlation between Gender and student attitudes toward AI painting. The regression coefficient for Education level is 0.712 ($t=27.827$, $p=0.000<0.01$), signifying a significant positive correlation between Education level and student attitudes toward AI painting. The regression coefficient for Artistic Design Background is -0.054 ($t=-1.358$, $p=0.175>0.05$). This suggests that Artistic Design Background does not have an effect on student attitudes toward AI painting. In conclusion, Education level correlates significantly and positively with student attitudes toward AI painting, while Gender demonstrates a significant, negative correlation. In addition, Artistic Design Background does not appear to affect student attitudes toward AI painting.

C. VARIANCE TEST

Our study identified a significant correlation between gender and student perceptions of AI painting technology. Male students demonstrated significantly more favorable attitudes ($M = 3.521$, $SD = 0.989$) compared to their female counterparts ($M = 3.029$, $SD = 0.806$). This difference was statistically significant ($F=96.432$, $p<0.001$), confirming our first hypothesis: gender significantly affects student attitudes toward AI painting technology.

Educational attainment significantly affected student perspectives on AI painting. A detailed analysis of the data indicated that positive perceptions increased progressively

TABLE 3. Internal and convergent validity assessment.

Construct	"Cronbach's Alpha (α)"	Loading	AVE	CR
I believe we should be educated about AI painting technology.	0.937	0.828		
I think students should have a forward-looking understanding of AI painting technology.	0.938	0.808	0.654	0.944
I believe that learning AI painting technology can enhance comprehensive capabilities.	0.938	0.797		
I think utilizing AI painting technology has a positive impact on the learning and understanding of art.	0.938	0.814		
I believe that the use of AI painting technology will promote its continuous improvement.	0.938	0.802		
I think utilizing AI painting technology can make image creation easier.	0.939	0.788		
I enjoy creating with AI painting.	0.937	0.827		
I find creating with AI painting interesting.	0.937	0.823		
When creating with AI painting， I can freely express my own ideas.	0.939	0.789		

TABLE 4. Pearson related evaluation.

Construct	Gender	Education level	Artistic Design Background
Students' attitude toward AI painting	0.263**	0.644**	-0.048

* p<0.05 ** p<0.01

TABLE 5. Results of linear regression analysis (n=1298).

Construct	B	SE	Beta	T	P	VIF	TOL
constant	2.188	0.110	-	19.949	0.000**	-	-
Gender	-0.120	0.042	-0.064	-2.864	0.004**	1.113	0.898
Education level	0.712	0.026	0.622	27.827	0.000**	1.114	0.898
Artistic Design Background	-0.054	0.040	-0.029	-1.358	0.175	1.001	0.999
R^2	0.419						
Adj. R^2	0.418						
F	F (3,1294) =310.936, p=0.000						
D-W statistic	0.879						

Dependent variable: Students' attitude toward AI painting. * p<0.05 ** p< 0.01

with each level of education. Students with a high school education or less had the lowest average attitude score (mean = 2.641, SD = 0.919), followed by undergraduates (mean = 3.306, SD = 0.705). Postgraduates demonstrated the highest average attitude score (mean = 4.121, SD = 0.254). This trend was statistically significant (F=460.753, p<0.001), confirming Hypothesis 2, which predicted that students' attitudes toward AI painting technology would be significantly affected by their education level.

However, the study did not indicate any significant differences in attitudes based on artistic design background. Students with an artistic design background (mean = 3.315, SD = 0.93) and those without (mean = 3.225, SD = 0.939) held similar views on AI painting (F=2.975, p=0.085). Therefore, Hypothesis 3, which proposed that an artistic design background would influence student attitudes toward AI painting, was not supported.

D. QUALITATIVE STUDY

Qualitative research, building upon the survey results, explored the multifaceted factors affecting students' diverse attitudes [76]. Through a process of coding, interview synthesis, and engagement with existing literature, our qualitative analysis expanded to consist of additional themes, including copyright ethics, concerns about job displacement and learning anxiety, personal values and aesthetic viewpoints, and broader societal environmental factors. Respecting participant confidentiality, identifying information has been anonymized, while retaining other essential demographic details.

E. COPYRIGHT ETHICAL ISSUES

The emergence of AI art, virtually indistinguishable from human creations, has ignited considerable debate surrounding copyright and ethical considerations [77], understandably causing concern among students. They might be concerned about the potential devaluation of human artistry in the face of AI-generated artwork. In addition, the process of developing these AI models raises concerns about ethical breaches, such as the unauthorized appropriation of artistic information. The question of copyright ownership regarding AI-generated artwork adds another layer of complexity [78]. Such concerns indeed affect student perspectives on AI painting.

For instance, Mr. Li, a high school student from Beijing, stated: "In our understanding, artworks are a reflection of human emotions and thoughts. AI paintings are electronic garbage generated by patching database content, not human original works. So, I don't think it should have copyright." (Male, 17 years old, KII, Beijing, China). Another high school student from Shenyang remarked: "AI's works have plagiarized the works of many artists who have dedicated their lives, AI's disrespect for copyright should be regarded as a thief's behavior, and in our group, AI's works are regarded as "stitching of art." (Female, 16 years old, IDI, Beijing, China); whereas, Mr. Wang, a university student from Shanghai, presented a contrasting perspective: "I think AI painting can be regarded as a new form of art. While AI does not have emotions or thoughts, it can be steered to create works of artistic value through prompts, which are also full of genuine human emotions." (Male, 22 years old, KII, Shanghai, China). Simultaneously, he addressed the

contentious copyright debate: ''I think the way AI model learns human painting style through algorithms is the same as we learners imitate the works of art masters at schools. We both learn the essence of painting through constant imitating. We learn the master's style and apply it to paint modern scenery, so can AI apply it to many different scenarios. This should be a convenience brought by technological innovation.'' Mr. Zhang, a doctoral student from Shenzhen, offered a profound interpretation of this matter: ''AI painting poses challenges to our societal perception and norms surrounding copyright. If we recognize the copyright of AI-generated works, it raises questions about redefining the notions of creator and the creative process. How much human intervention is necessary for AI-generated works to be considered copyrightable and inherently artistic? This complex issue demands deep contemplation and consideration.'' (Male, 26 years old, IDI, Shenzhen, China).

These diverse perspectives highlight the continuing debate surrounding copyright and ethical considerations in AI painting. Some individuals maintain that humans should be the sole creators of artworks, stressing the significance of emotions and thoughts in artistic expression. They assert that AI-generated content should not be eligible for copyright protection and should be prohibited from commercial use. In contrast, others support extending copyright protection to AI paintings, acknowledging their capacity to produce works of artistic merit. Educational attainment also appears as a significant factor affecting these perspectives. High school students are more likely to adhere to prevailing social conventions, whereas university students and graduate students exhibit a greater degree of receptivity and acceptance toward novel concepts. These points of contention map out the factors that affect student attitudes toward AI.

F. JOB REPLACEMENT AND LEARNING ANXIETY

As AI becomes increasingly integrated into various fields, including artistic creation, students may find themselves suffering from career anxiety [79], [80], [81], [82]. Concerns about future job prospects and the transferability of their skills to the workplace are likely to arise. The swift progress of AI could also generate pressure on students, leading them to fear that their dedication to mastering fundamental drawing methods might become obsolete. At the same time, students may feel anxious about the need to quickly learn and adapt to new technologies and tools to stay competitive in a shifting job market. These anxieties contribute to the diverse range of student perspectives on AI's role in art.

In interviews, Lin, a high school student from Guangzhou, expressed, ''I've always dreamed of painting, but when I see how swiftly AI can paint, I start to worry whether I should go and acquire more competitive skills.'' (Female, 17 years old, KII, Guangzhou, China). A college student specializing in art design from Chengdu, Zhang, worried, ''I am studying art design, but I worry that as AI painting technology becomes more advanced, it might replace our work. So, what's the point of investing so much time and effort in learning professional skills?'' (Male, 21 years old, IDI, Chengdu, China). However, a college student from Wuhan presented a contrasting viewpoint: ''Undoubtedly, AI has its advantages in many areas, including artistic creation, but I believe, which AI cannot replace. We think that innovative thinking and deep thinking are key to future job competition.'' (Female, 22 years old, KII, Wuhan, China). Sharing a similar perspective, Xu, a graduate art student from Hangzhou, said: ''The purpose of my art study is to explore the depth and breadth of art and its connection with human life. In rapid AI development, we should learn new AI skills to adapt to the needs of the AI era.'' (Male, 24 years old, KII, Hangzhou, China). Meanwhile, Chen, an art design PhD candidate from Nanjing, argued, ''The development of AI has undoubtedly sparked a new discussion about the essence of artistic creation. I believe this is an opportunity for us, instead of a threat. It requires us to reconsider the process of artistic creation, rethink our role in this process. Artworks created by AI can ignite human exploration in the art field, pave the way for new art forms and new art languages, and even lead to new university courses and job positions.'' (Male, 29 years old, IDI, Nanjing, China).

G. INFLUENCE OF PERSONAL VALUES AND AESTHETIC JUDGMENT

Students' attitudes toward AI painting likely vary depending on their personal values and artistic sensibilities. For some, the value of art lies in its originality and uniqueness; these students may be hesitant to embrace AI-created pieces. Others may be more open to new technologies, seeing AI painting as a novel art form brimming with potential. From a purely aesthetic standpoint, some students find AI paintings intriguing, while others find them repetitive and lacking personality.

During interviews, some students expressed skepticism about AI paintings. Wu (pseudonym), a high school student from Xiamen, shared her perspective: ''I personally believe that art creation should be a means of expressing emotions and humanity. AI paintings cannot possess real emotions, so I don't think they can be classified as genuine works of art. While their works may be technically exquisite, I feel they lack the soul of an artistic piece.'' (Female, 18 years old, KII, Xiamen, China). Echoing this sentiment, Li (pseudonym), an art and design student from Beijing, added, ''Despite the breakthroughs in AI painting technology, I believe their works are 'immediately recognizable as AI', homogeneous and lacking the spirituality of painting. Genuine artistic creation should be unique, a reflection of the artist's inner world. If AI only imitates human art styles, the art it creates lacks real value.'' (Female, 22 years old, IDI, Beijing, China). However, other students embraced the potential of AI painting. Zhao (pseudonym), a university student from Hangzhou, offered a different view: ''I regard AI painting as a new form of art. Like photography, initially questioned whether it belonged to art, but now it has become an important means of artistic expression. AI painting may lack on the emotional level, but

in form and method, it presents new possibilities." (Male, 21 years old, KII, Hangzhou, China). Zhang (pseudonym), a master's student from Chengdu, agreed: "I am deeply interested in the works of AI painting. The painting style of AI presents a new aesthetic experience for me. This makes me realize that the definition of art is open and should not be limited by our traditional notions." (Male, 24 years old, IDI, Chengdu, China).

H. IMPACT OF SOCIAL ENVIRONMENT

Students' attitudes toward AI painting are also affected by their social surroundings. Research indicates that cultural contexts significantly affect how users view AI technologies [83]. In environments where AI painting is viewed negatively or with skepticism, students are more likely to develop reservations about it; whereas, when peers, teachers, and industry leaders embrace and champion AI painting, students are more likely to adopt a positive attitude. Therefore, the social climate surrounding AI painting affect students' diverse attitudes toward this technology.

"My art teacher has a very negative attitude toward AI painting," shared Chongqing, Zhao (pseudonym), a high schooler. "He thinks it has a negative impact on our creative skills because we become dependent on AI and neglect self-innovation and practice. His view has had a significant effect on me, making me wary of AI painting." (Male, 16 years old, IDI, Chongqing, China). Hangzhou, Yang (pseudonym), a university student, held a contrary opinion. "In our design course, we are encouraged to experiment with and use AI painting tools. I believe this is a great exploration, AI tools can help us expand our design ideas and quickly and effectively transform them into actual works. This practical experience of utilizing AI will also be beneficial to our future careers." (Female, 20 years old, KII, Hangzhou, China). "My internship actually encourages us to use AI tools for creative stuff, too," expressed by Wei (pseudonym), a third-year postgraduate student interning in Shanghai. "The company where I am interning encourages us to utilize AI tools for creative purposes. It saves our time and improves efficiency. The use of AI-assisted creation is an unspoken truth in the industry." (Male, 25 years old, KII, Shanghai, China).

V. DISCUSSION

This study evaluates the attitudes held by Chinese students toward AI painting technology, analyzing key contributing factors to shed light on the cognitive structures surrounding AI in creative fields. Quantitative analysis findings demonstrate a significant positive correlation between educational attainment and student perceptions of AI painting technology. Gender also exhibits a critical influence; however, a background in art and design does not appear to be significant.

Firstly, the analysis indicated a strong correlation between gender and student attitudes toward AI painting technology. Male students demonstrated significantly more favorable views of AI painting technology compared to their female counterparts, who expressed more negative sentiments. This difference was statistically significant ($F=96.432$, $p<0.001$), with male students, on average, scoring much higher in their attitude evaluations. This confirms a clear gender gap in how Chinese students perceive AI painting technology (verifying Hypothesis 1) and aligning with the findings of Cai [54]. This is consistent with the notion that gender roles may affect how individuals approach new technologies, with men often displaying greater acceptance than women [54]. Secondly, our research highlights the significant positive effect of education level on attitudes toward AI technology (verifying Hypothesis 2). This highlights the crucial role education plays in cultivating acceptance and understanding of AI, supporting the work of Ardies [56] who also found a correlation between education level and technological perceptions. This suggests that higher levels of education may cultivate a more in-depth and inclusive understanding of AI technology. Specifically, we did not find a significant relationship between art and design backgrounds and attitudes toward AI painting technology (Hypothesis 3 not verified). This potentially indicates a broader trend of embracing AI's creative applications, even in fields typically known for their cautious approach to technology. This challenges the traditional assumption that artists and designers, who place a premium on originality and creativity, might be wary of AI technology [5], [15]. A possible explanation is that the impressive capabilities and user-friendliness of AI painting tools may actually empower artists and designers in their creative processes.

A qualitative analysis indicated the multidimensional factors in which students' attitudes toward AI painting technology are influenced, including considerations of copyright ethics, anxieties about job displacement, personal values and aesthetic judgments, and the effect of the social environment. These in-depth insights enrich the findings of the quantitative research, offering a more comprehensive understanding of the mechanisms underlying students' attitudes.

Many participants voiced concerns about AI painting potentially violating human artists' copyrights. This concern reflects the ethical and legal dilemmas posed by AI's integration into the creative process, as highlighted in Sætra's study [78]. It questions the essence of human engagement and feeling in creative expression when compared to AI paintings. These perspectives indicate a fundamental issue in AI art development, stressing the ethical aspects requiring attention, particularly regarding the originality and ownership of artworks. Students' anxieties about AI possibly displacing artists and designers in the job market reflect broader insecurities about future career prospects. They worry that the progress of AI tools might reduce their extensive training in drawing and software, potentially compelling them to vie with those lacking formal training who can utilize AI tools. This aligns with Hamid et al. research [82], which evaluated the effect of technological progress on future occupations. Such concerns might affect their willingness to embrace AI technology, especially given its potential uses in creative sectors. However, as educational institutions incorporate AI painting skills into their curricula, students might gradually

perceive AI as a necessary skill for career advancement, thus boosting their acceptance. The weight of personal values and aesthetic judgments on attitudes toward AI painting technology illustrates that, in art, individual acceptance and understanding of new technologies originate from their values and aesthetic perspectives. Individual aesthetic tastes and value systems, through the perspective of art perception and understanding, affect attitudes toward AI painting technology. These attitudes are not formed independently but arise from the relationship of personal encounters, knowledge bases, and cultural values. Exposure to a variety of cultures and art forms might contribute to nurturing a more receptive stance toward AI technology. The social environment, including educational and cultural backgrounds, significantly molds students' attitudes. This aligns with Wu et al. findings [83], which indicated that cultural backgrounds directly affect technology acceptance. A positive social and educational setting may promote the exploration and acceptance of AI art technology, whereas a restrictive environment might hinder such acceptance. Family, school, teachers, and peer groups, as primary socialization agents, not only offer avenues for learning and interaction but also convey specific cultural values and societal norms, significantly affecting students' attitudes toward AI art.

This study presents several limitations. The reliance on self-reported measures may have introduced potential biases into the data, as participants could have overestimated their acceptance or understanding of AI technology. Moreover, the study's focus on Chinese students limits the generalizability of its findings to other cultural and educational contexts. The rapid progression of AI technology suggests that attitudes toward AI painting are subject to change, necessitating continuous research to track these shifts. Based on the findings, the study proposes several recommendations for future research. Future analyses could explore cross-cultural perspectives to understand how differing educational systems and cultural backgrounds influence students' attitudes toward AI painting. Longitudinal studies could offer insights into how these attitudes develop over time as AI technology is progressively integrated into educational curricula and professional practices. Besides, future research should consider incorporating more experimental designs to appraise the effect of various teaching methodologies and technological training on students' attitudes. These lines of inquiry will contribute to a more comprehensive understanding of the acceptance of and factors influencing AI painting technology in diverse cultural and educational contexts. Finally, applying this research findings to practical education and training settings can offer empirical evidence for the effectiveness of different approaches, finally leading to further optimizations and optimizations in integrating AI technologies in the artistic domain.

VI. CONCLUSION

This study evaluated the attitudes of Chinese students toward AI painting technology, utilizing a mixed-methods approach to understand the factors affecting their views. A quantitative analysis indicated that perceptions were significantly affected by gender, education level, and prior experience with art and design. Qualitative findings further emphasized the crucial roles played by copyright concerns, fears of job displacement, anxieties about acquiring new skills, personal values, aesthetic judgments, and broader societal influences. This research sheds light on the ongoing conversation between technological innovation and traditional artistic values, positioning AI painting as a tool capable of both enhancing creativity and raising concerns about its wider implications. This mix of enthusiasm and concern reflects broader societal debates about the role of technology in human creativity. By understanding these diverse perspectives, stakeholders can better navigate the integration of AI into the art world, ensuring it complements, rather than displaces, human creativity.

REFERENCES

[1] M. M. M. Peeters, J. van Diggelen, K. van den Bosch, A. Bronkhorst, M. A. Neerincx, J. M. Schraagen, and S. Raaijmakers, "Hybrid collective intelligence in a human—AI society," *AI Soc.*, vol. 36, no. 1, pp. 217–238, Mar. 2021, doi: 10.1007/s00146-020-01005-y.

[2] C. Pelau, D.-C. Dabija, and I. Ene, "What makes an AI device human-like? The role of interaction quality, empathy and perceived psychological anthropomorphic characteristics in the acceptance of artificial intelligence in the service industry," *Comput. Hum. Behav.*, vol. 122, Sep. 2021, Art. no. 106855, doi: 10.1016/j.chb.2021.106855.

[3] Z. Wu, D. Ji, K. Yu, X. Zeng, D. Wu, and M. Shidujaman, "AI creativity and the human-AI co-creation model," in *Human-Computer Interaction. Theory, Methods and Tools* (Lecture Notes in Computer Science), M. Kurosu, Ed. Cham, Switzerland: Springer, 2021, pp. 171–190, doi: 10.1007/978-3-030-78462-1_13.

[4] S. Feng, "The application of artificial intelligence technology in the field of artistic creation," in *Proc. Int. Conf. Cogn. Based Inf. Process. Appl. (CIPA)* (Lecture Notes on Data Engineering and Communications Technologies), B. J. Jansen, H. Liang, and J. Ye, Eds. Singapore: Springer, 2022, pp. 537–543, doi: 10.1007/978-981-16-5857-0_69.

[5] S. G. Chiarella, G. Torromino, D. M. Gagliardi, D. Rossi, F. Babiloni, and G. Cartocci, "Investigating the negative bias towards artificial intelligence: Effects of prior assignment of AI-authorship on the aesthetic appreciation of abstract paintings," *Comput. Hum. Behav.*, vol. 137, Dec. 2022, Art. no. 107406, doi: 10.1016/j.chb.2022.107406.

[6] L. Sartori and G. Bocca, "Minding the gap(s): Public perceptions of AI and socio-technical imaginaries," *AI Soc.*, vol. 38, no. 2, pp. 443–458, Apr. 2023, doi: 10.1007/s00146-022-01422-1.

[7] M. A. Boden and E. A. Edmonds, "What is generative art?" *Digit. Creativity*, vol. 20, nos. 1–2, pp. 21–46, Jun. 2009, doi: 10.1080/14626260902867915.

[8] P. Galanter, "Generative art theory," in *A Companion to Digital Art*. Hoboken, NJ, USA: Wiley, 2016, pp. 146–180, doi: 10.1002/9781118475249.ch5.

[9] M. A. Runco and G. J. Jaeger, "The standard definition of creativity," *Creativity Res. J.*, vol. 24, no. 1, pp. 92–96, Jan. 2012, doi: 10.1080/10400419.2012.650092.

[10] K. Crowson, S. Biderman, D. Kornis, D. Stander, E. Hallahan, L. Castricato, and E. Raff, "VQGAN-CLIP: Open domain image generation and editing with natural language guidance," 2022, *arXiv:2204.08583*.

[11] J. Oppenlaender, "The creativity of text-to-image generation," in *Proc. 25th Int. Academic Mindtrek Conf.*, Tampere, Finland, Nov. 2022, pp. 192–202, doi: 10.1145/3569219.3569352.

[12] J.-W. Hong and N. M. Curran, "Artificial intelligence, artists, and art: Attitudes toward artwork produced by humans vs. artificial intelligence," *ACM Trans. Multimedia Comput., Commun., Appl.*, vol. 15, no. 2s, p. 58, Jul. 2019, doi: 10.1145/3326337.

[13] M. Ragot, N. Martin, and S. Cojean, "Ai-generated vs. human artworks. A perception bias towards artificial intelligence?" in *Proc. Extended Abstr. CHI Conf. Hum. Factors Comput. Syst. (CHI EA)*. New York, NY, USA, Apr. 2020, pp. 1–10, doi: 10.1145/3334480.3382892.

[14] P. Fortuna and A. Modliński, "A(I)rtist or counterfeiter? Artificial intelligence as (D)evaluating factor on the art market," *J. Arts Manag., Law, Soc.*, vol. 51, no. 3, pp. 188–201, May 2021, doi: 10.1080/10632921.2021.1887032.

[15] E. S. Mikalonytė and M. Kneer, "Can Artificial Intelligence make art?: Folk intuitions as to whether AI-driven robots can be viewed as artists and produce art," *ACM Trans. Hum.-Robot Interact.*, vol. 11, no. 4, p. 43, Sep. 2022, doi: 10.1145/3530875.

[16] W. R. Mead and R. Kurzweil, "The singularity is near: When humans transcend biology," *Foreign Affairs*, vol. 85, no. 3, p. 160, 2006, doi: 10.2307/20031996.

[17] J.-W. Hong, "Bias in perception of art produced by artificial intelligence," in *Human-Computer Interaction. Interaction in Context* (Lecture Notes in Computer Science), vol. 10902, M. Kurosu, Ed. Cham, Switzerland: Springer, 2018, pp. 290–303, doi: 10.1007/978-3-319-91244-8_24.

[18] Y. Ding, "Humanity concerns of AI nanny (by proving differences between AI nanny and government), the protection of mankind in singularity," presented at the Int. Conf. Social Sci. Humanities Arts (SSHA), Nanjing, China, 2022, doi: 10.2991/assehr.k.220401.180.

[19] R. Marrone, V. Taddeo, and G. Hill, "Creativity and artificial intelligence—A student perspective," *J. Intell.*, vol. 10, no. 3, p. 65, Sep. 2022, doi: 10.3390/jintelligence10030065.

[20] J. Weatherbed. *ArtStation is Hiding Images That Protest Against AI Art*. Accessed: Jun. 2, 2023. [Online]. Available: https://www.theverge.com/2022/12/23/23523864/artstation-removing-anti-ai-protest-artwork-censorship

[21] B. Brittain and B. Brittain. (Jan. 17, 2023). *Lawsuits Accuse AI Content Creators of Misusing Copyrighted Work*. Accessed: Jun. 2, 2023. [Online]. Available: https://www.reuters.com/legal/transactional/lawsuits-accuse-ai-content-creators-misusing-copyrighted-work-2023-01-17/

[22] *[Deleted by User]*. Accessed: Jun. 9, 2023. [Online]. Available: https://www.reddit.com/r/StableDiffusion/comments/ym90a3/deleted_by_user/

[23] E. J. Beyer. *The AI-Generated Art Debate is Here. and It's Very Messy*. Accessed: Jun. 9, 2023. [Online]. Available: https://nftnow.com/features/the-ai-generated-art-debate-is-here-and-its-very-messy/

[24] H. Vartiainen and M. Tedre, "Using artificial intelligence in craft education: Crafting with text-to-image generative models," *Digit. Creativity*, vol. 34, no. 1, pp. 1–21, Jan. 2023, doi: 10.1080/14626268.2023.2174557.

[25] M. Arbiza Goenaga, "A critique of contemporary artificial intelligence art: Who is edmond de belamy?" *AusArt*, vol. 8, no. 1, pp. 51–66, Jun. 2020, doi: 10.1387/ausart.21490.

[26] J. Xu et al., "Is everyone an artist? A study on user experience of AI-based painting system," *Appl. Sci.*, vol. 13, no. 11, 2023, Art. no. 6496.

[27] E. Dans. *It's AI: But is it Art?* Accessed: Jun. 9, 2023. [Online]. Available: https://medium.com/enrique-dans/its-ai-but-is-it-art-fb7861e799af

[28] J. Zylinska, *AI Art: Machine Visions and Warped Dreams*. London, U.K.: Open Humanities Press, 2020. Accessed: Jun. 2, 2023. [Online]. Available: https://library.oapen.org/handle/20.500.12657/40042

[29] K. Browne, "Who (or What) is an AI artist?" *Leonardo*, vol. 55, no. 2, pp. 130–134, Apr. 2022, doi: 10.1162/leon_a_02092.

[30] F. C. Pereira, *Creativity and Artificial Intelligence: A Conceptual Blending Approach*. Berlin, Germany: Walter de Gruyter, 2007.

[31] M. Miller, N. J. Stone, C. Ballantyne, V. Bittner, M. H. Criqui, H. N. Ginsberg, A. C. Goldberg, W. J. Howard, M. S. Jacobson, P. M. Kris-Etherton, T. A. Lennie, M. Levi, T. Mazzone, and S. Pennathur, "Triglycerides and cardiovascular disease: A scientific statement from the American heart association," *Circulation*, vol. 123, no. 20, pp. 2292–2333, May 2011, doi: 10.1161/cir.0b013e3182160726.

[32] P. Hariharan and A. Nichol, "Diffusion models beat GANs on image synthesis," in *Proc. Adv. Neural Inf. Process. Syst.*, vol. 34, 2021, pp. 8780–8794.

[33] V. Liu and L. B. Chilton, "Design guidelines for prompt engineering text-to-image generative models," in *Proc. CHI Conf. Hum. Factors Comput. Syst.*, 2022, pp. 1–23.

[34] J. Oppenlaender, "The creativity of text-based generative art," 2022, *arXiv:2206.02904*.

[35] R. F. Malina, "Aaron's code: Meta-art, artificial intelligence and the work of Harold Cohen by Pamela McCorduck," *Leonardo*, vol. 24, no. 5, pp. 628–629, 1991.

[36] Q. V. Le, "Building high-level features using large scale unsupervised learning," in *Proc. IEEE Int. Conf. Acoust., Speech Signal Process.*, May 2013, pp. 8595–8598.

[37] I. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. Courville, and Y. Bengio, "Generative adversarial networks," 2014, *arXiv:1406.2661*.

[38] K. Wang, C. Gou, Y. Duan, Y. Lin, X. Zheng, and F.-Y. Wang, "Generative adversarial networks: Introduction and outlook," *IEEE/CAA J. Automatica Sinica*, vol. 4, no. 4, pp. 588–598, Sep. 2017.

[39] I. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. Courville, and Y. Bengio, "Generative adversarial networks," *Commun. ACM*, vol. 63, no. 11, pp. 139–144, Oct. 2020, doi: 10.1145/3422622.

[40] A. Radford, J. W. Kim, C. Hallacy, A. Ramesh, G. Goh, S. Agarwal, G. Sastry, A. Askell, P. Mishkin, J. Clark, G. Krueger, and I. Sutskever, "Learning transferable visual models from natural language supervision," in *Proc. 38th Int. Conf. Mach. Learn.*, 2021, pp. 8748–8763.

[41] R. Rombach, A. Blattmann, D. Lorenz, P. Esser, and B. Ommer, "High-resolution image synthesis with latent diffusion models," in *Proc. IEEE/CVF Conf. Comput. Vis. Pattern Recognit. (CVPR)*, Jun. 2022, pp. 10684–10695.

[42] D. C. Morris, "A survey of age and attitudes toward computers," *J. Educ. Technol. Syst.*, vol. 17, no. 1, pp. 73–78, Sep. 1988, doi: 10.2190/2h58-knvp-3el9-qla6.

[43] X. Liu, "Artistic reflection on artificial intelligence digital painting," in *Proc. J. Phys., Conf.*, vol. 1648, no. 3, Oct. 2020, Art. no. 032125, doi: 10.1088/1742-6596/1648/3/032125.

[44] Y. Lyu, X. Wang, R. Lin, and J. Wu, "Communication in human—AI co-creation: Perceptual analysis of paintings generated by text-to-image system," *Appl. Sci.*, vol. 12, no. 22, p. 11312, Nov. 2022, doi: 10.3390/app122211312.

[45] Y. Sun, Y. Lyu, P.-H. Lin, and R. Lin, "Comparison of cognitive differences of artworks between artist and artistic style transfer," *Appl. Sci.*, vol. 12, no. 11, p. 5525, May 2022, doi: 10.3390/app12115525.

[46] N. Pavlichenko and D. Ustalov, "Best prompts for text-to-image models and how to find them," 2022, *arXiv:2209.11711*.

[47] A. Newton and K. Dhole, "Is AI art another industrial revolution in the making?" 2023, *arXiv:2301.05133*.

[48] J. McCormack, C. Cruz Gambardella, N. Rajcic, S. James Krol, M. Teresa Llano, and M. Yang, "Is writing prompts really making art?" 2023, *arXiv:2301.13049*.

[49] T. Pell and T. Jarvis, "Developing attitude to science scales for use with children of ages from five to eleven years," *Int. J. Sci. Educ.*, vol. 23, no. 8, pp. 847–862, Aug. 2001, doi: 10.1080/09500690010016111.

[50] P. Kind, K. Jones, and P. Barmby, "Developing attitudes towards science measures," *Int. J. Sci. Educ.*, vol. 29, no. 7, pp. 871–893, Jun. 2007, doi: 10.1080/09500690600909091.

[51] K. H. Becker and S. Maunsaiyat, "Thai students' attitudes and concepts of technology," *J. Technol. Educ.*, vol. 13, no. 2, pp. 6–20, May 2002.

[52] P. I. Devitasari, I. Wilujeng, S. A. Azhary, and M. A. I. Sadewo, "The development of natural science module web integrated with local plants toward cooperation skills and environmental care attitude of students," in *Proc. J. Phys., Conf.*, May 2021, vol. 1882, no. 1, Art. no. 012094, doi: 10.1088/1742-6596/1882/1/012094.

[53] E. A. Bame, W. E. Dugger, M. de Vries, and J. McBee, "Pupils' attitudes toward technology—PATT-USA," *J. Technol. Stud.*, vol. 19, no. 1, pp. 40–48, 1993.

[54] Z. Cai, X. Fan, and J. Du, "Gender and attitudes toward technology use: A meta-analysis," *Comput. Educ.*, vol. 105, pp. 1–13, Feb. 2017, doi: 10.1016/j.compedu.2016.11.003.

[55] S. Yavuz, "Developing a technology attitude scale for pre-service chemistry teachers," *Turkish Online J. Educ. Technol.*, vol. 4, no. 1, pp. 17–25, Jan. 2005.

[56] J. Ardies, S. De Maeyer, D. Gijbels, and H. van Keulen, "Students attitudes towards technology," *Int. J. Technol. Des. Educ.*, vol. 25, no. 1, pp. 43–65, Feb. 2015, doi: 10.1007/s10798-014-9268-x.

[57] B. A. Collis and R. L. Williams, "Cross-cultural comparison of gender differences in adolescents' attitudes toward computers and selected school subjects," *J. Educ. Res.*, vol. 81, no. 1, pp. 17–27, Sep. 1987, doi: 10.1080/00220671.1987.10885792.

[58] C.-S. Ong and J.-Y. Lai, "Gender differences in perceptions and relationships among dominants of e-learning acceptance," *Comput. Hum. Behav.*, vol. 22, no. 5, pp. 816–829, Sep. 2006, doi: 10.1016/j.chb.2004.03.006.
[59] L. A. Jackson, K. S. Ervin, P. D. Gardner, and N. Schmitt, "Gender and the internet: Women communicating and men searching," *Sex Roles*, vol. 44, nos. 5–6, pp. 363–379, 2001, doi: 10.1023/A:1010937901821.
[60] A. Durndell and Z. Haag, "Computer self efficacy, computer anxiety, attitudes towards the internet and reported experience with the internet, by gender, in an east European sample," *Comput. Hum. Behav.*, vol. 18, no. 5, pp. 521–535, Sep. 2002, doi: 10.1016/s0747-5632(02)00006-7.
[61] D. Roberts, *An Apology for the Life of Mr Colley Cibber, Comedian and Late Patentee of the Theatre Royal: A Modernized Text*, 1st ed. Cambridge, U.K.: Cambridge Univ. Press, 2022, doi: 10.1017/9781009093019.
[62] M. de Vries, "Techniek in het natuurkunde-onderwijs," Ph.D. thesis, 1988.
[63] T. K.-L. Ho and H.-S. Lin, "A web-based painting tool for enhancing student attitudes toward learning art creation," *Comput. Educ.*, vol. 89, pp. 32–41, 2015.
[64] K. S. Volk and W. M. Yip, "Gender and technology in Hong kong: A study of Pupils' attitudes toward technology," *Int. J. Technol. Des. Educ.*, vol. 9, no. 1, pp. 57–71, Jan. 1999.
[65] B. Mawson, "Children's developing understanding of technology," *Int. J. Technol. Des. Educ.*, vol. 20, pp. 1–13, Jun. 2010.
[66] M. J. De Vries, *Teaching About Technology: An Introduction to the Philosophy of Technology for Non-Philosophers*. Springer, 2016.
[67] H. Rees and J. M. Noyes, "Mobile telephones, computers, and the internet: Sex differences in Adolescents' use and attitudes," *CyberPsychol. Behav.*, vol. 10, no. 3, pp. 482–484, Jun. 2007.
[68] D. Kotte, "Gender differences in science achievement in 10 countries: 1970/71 to 1983/84," 1992.
[69] S. Catsambis, "Gender, race, ethnicity, and science education in the middle grades," *J. Res. Sci. Teach.*, vol. 32, no. 3, pp. 243–257, Mar. 1995, doi: 10.1002/tea.3660320305.
[70] J. Beggs and C. Murphy, "Primary science in the U.K.: A scoping study," in *Final report to the Wellcome Trust. London: Wellcome Trust*, D. Beijaard, J. van Driel, Eds. London, U.K.: Wellcome Trust, 2005.
[71] C. M. A. Haworth, P. Dale, and R. Plomin, "A twin study into the genetic and environmental influences on academic performance in science in nine-year-old boys and girls," *Int. J. Sci. Educ.*, vol. 30, no. 8, pp. 1003–1025, Jun. 2008, doi: 10.1080/09500690701324190.
[72] M. Bahar and M. Asil, "Attitude towards e-assessment: Influence of gender, computer usage and level of education," *Open Learn., J. Open, Distance e-Learn.*, vol. 33, no. 3, pp. 221–237, Sep. 2018, doi: 10.1080/02680513.2018.1503529.
[73] P. M. Tikka, M. T. Kuitunen, and S. M. Tynys, "Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment," *J. Environ. Educ.*, vol. 31, no. 3, pp. 12–19, Jan. 2000, doi: 10.1080/00958960009598640.
[74] F. Tegegne, A. Aziz, H. Bhavsar, and R. Wiemers, "Awareness of and attitudes towards biotechnology by Tennessee State University students with different backgrounds and majors," *J. Biotech Res.*, vol. 5, p. 16, Jan. 2013.
[75] J. F. Hair, J. J. Risher, M. Sarstedt, and C. M. Ringle, "When to use and how to report the results of PLS-SEM," *Eur. Bus. Rev.*, vol. 31, no. 1, pp. 2–24, Jan. 2019, doi: 10.1108/ebr-11-2018-0203.
[76] J. Li and J.-S. Huang, "Dimensions of artificial intelligence anxiety based on the integrated fear acquisition theory," *Technol. Soc.*, vol. 63, Nov. 2020, Art. no. 101410, doi: 10.1016/j.techsoc.2020.101410.
[77] M. Anderson and S. L. Anderson, "Machine ethics: Creating an ethical intelligent agent," *AI Mag.*, vol. 28, no. 4, p. 15, 2007.
[78] H. S. Sætra, "Freedom under the gaze of big brother: Preparing the grounds for a liberal defence of privacy in the era of big data," *Technol. Soc.*, vol. 58, Aug. 2019, Art. no. 101160.
[79] R. K. Heinssen, C. R. Glass, and L. A. Knight, "Assessing computer anxiety: Development and validation of the computer anxiety rating scale," *Comput. Hum. Behav.*, vol. 3, no. 1, pp. 49–59, Jan. 1987.
[80] L. D. Rosen, D. C. Sears, and M. M. Weil, "Computerphobia," *Behav. Res. Methods, Instrum., Comput.*, vol. 19, no. 2, pp. 167–179, 1987.
[81] R. N. Carleton, "Fear of the unknown: One fear to rule them all?" *J. Anxiety Disorders*, vol. 41, pp. 5–21, Jun. 2016.
[82] O. H. Hamid, N. L. Smith, and A. Barzanji, "Automation, per se, is not job elimination: How artificial intelligence forwards cooperative human-machine coexistence," in *Proc. IEEE 15th Int. Conf. Ind. Informat. (INDIN)*, Jul. 2017, pp. 899–904.
[83] Y. Wu, Y. Mou, Z. Li, and K. Xu, "Investigating American and Chinese subjects' explicit and implicit perceptions of AI-generated artistic work," *Comput. Hum. Behav.*, vol. 104, Mar. 2020, Art. no. 106186, doi: 10.1016/j.chb.2019.106186.

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